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Research Article

DETERMINATION OF HEAVY METALS IN DIFFERENT HERBAL TEA SAMPLES FOUND IN LAGOS, NIGERIA

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ABSTRACT
Heavy metals (Cr, Cu, Fe, Mn, Pb, Co and Cd) were determined in ten different brands of imported teas found in various markets in Lagos, Nigeria. All samples were treated using acid digestion method and the metals were determined using Atomic Absorption Spectrophotometry. The result of analysis showed that the content of lead in all tea samples ranged from 0.00mg/kg – 0.27mg/kg. The highest chromium value was found in Lipton tea (1.26mg/kg) while the only nickel value was found in Typhoid tea (0.09mg/kg). Copper levels ranged from 0.01mg/kg in Top Tea to 0.20mg/kg in Lipton tea. Cadmium was not found in all the samples while the highest cobalt level was 0. 93mg/kg in Typhoid tea which also contains a high level of copper, lead and nickel. Cadmium was not detected in all the herbal teas studied while lead and nickel were found only in typhoid tea. Lipton tea contains the highest level of chromium (1.26mg/kg) followed by Antimalaria tea (1.04mg/kg).

Keywords: *Herbal Tea, Atomic Absorption Spectrophotometry, Heavy Metals, Nigeria, Lagos*

INTRODUCTION
Tea is one of the most common beverages in the world today. It is the agricultural product of leaves, buds and internodes of the *Camellia sinensis* plant prepared and cured by various methods. Tea also refers to the aromatic beverages prepared from the cured leaves by combination with hot water (Seenivasan *et al*., 2008). Herbal teas are generally consumed for their physical or medicinal effects, especially for their stimulant, relaxant or calming features (Kara, 2009; Hussain & Khan, 2006). Saponin isolated from tea has been found to decrease blood pressure (Nworgu *et al*., 2008).
Plants absorb metals mostly in ionic forms with the help of their roots. The genus of the pH, environmental conditions and the nature of the metal play a major role concerning the metal intake. The absorbed metal is accumulated in different parts of the plant (root, leaf, fruit, seed etc). Human consumption of any part of the plant gives room to introduction of the plant, including the metals into the food chain (Soomro & Zahir, 2008).
A heavy metal is a member of an ill-defined subset of elements that exhibit metallic properties which would mainly include the transition metals, some metalloids, lanthanides and actinides. Human beings require trace amounts of heavy metals (iron, cobalt, copper, manganese, and molybdenum & zinc). Excessive levels of these metals can damage the organisms.
Some heavy metals are dangerous to health and the environment, e.g. mercury, cadmium, arsenic, lead, chromium, nickel etc (Hussain *et al.*, 2011).
In this study, ten different popular herbal teas commercially available in the local market in Lagos, Nigeria were used to determine the heavy metal intake by humans via tea intake.

MATERIALS AND METHODS
Apparatus: Atomic Absorption Spectrophotometer was used for the determination of the heavy metals. The operating parameters were set as recommended by the manufacturer.
Chemicals: All the chemicals used during the experiments were of analytical grade.
Sample: Ten different herbal tea samples used for relaxation and medical purposes across Lagos State were bought from the market.
Digestion Method: The tea samples were oven dried at 105ºC to a constant weight. Each sample was grinded to a powdered form using a blender.

All the powdered samples were kept in desiccators at room temperature until the process of analysis.
5g of each powdered sample was weighed and mixed with 20ml of nitric acid and perchloric acid (14:6 v/v). The mixture was heated at 130ºC for one hour until the sample dissolved. The samples were filtered with black filter paper and the volume adjusted to 50ml with deionized water. The different digests of tea samples were analyzed for heavy metals content using the AAS (AOAC, 2000).

Calibration

Calibration curves were prepared to determine the concentration of the metals in the sample solutions. The calibration standards are shown in Table 1. Calibration curves for each of each of the metals were made from dilute solution prepared from stock standard solutions containing 100mg/l in 2% HNO_3 of the metals: Mn, Mg, Fe, Zn, Cu, Cd and Pb.
For each sample, three repeat measurements were performed. The results were obtained from the mean of each measurement (Perkin-Elmer, 2000).

Table 1: The Experimental Conditions

Element	**Wavelength (nm)**	**R**
Mg	285.3	1
Mn	279.5	1
Fe	248.3	1
Co	240.7	0.9915
Ni	232.0	0.9990
Cu	342.8	1
Zn	213.9	0.9905
Pd	217.7	1
Cd	228.8	1

Table 2: Trace Metal Concentrations Present in Different Tea Samples (mg/kg)

Tea Samples		**Concentration (mg/kg)**				
		Zn	**Fe**	**Mn**	**Cu**	**Mg**
1	Typhoid tea	7.64±0.08	18.11±0.16	0.05±0.01	0.06±0.01	4.92±0.06
2	Green tea	8.30±0.10	8.23±0.07	0.05±0.01	0.03±0.03	3.84±0.02
3	Top tea	5.11±0.06	9.30±0.04	0.07±0.02	0.11±0.01	3.00±0.01
4	Lipton tea	6.62± 0.04	7.51±0.02	0.03±0.03	0.20±0.06	5.20±0.03
5	Lung flush tea	9.04± 0.01	6.94±0.04	0.07±0.01	0.11±0.07	6.84±0.02
6	Anti malaria tea	10.45 ±0.12	7.35±0.03	0.07±0.02	0.11±0.01	2.98±0.01
7	Tummy fat reducing tea	5.69±0.04	9.01±0.07	0.06±0.01	0.09±0.01	3.99±0.01
8	Ballerina tea	8.49±0.07	7.95±0.04	0.05±0.01	0.10±0.03	5.42±0.07
9	Super herb sliming tea	9.14±0.05	4.55±0.04	0.05±0.01	0.11±0.01	6.81±0.04
10	Diabetes tea	10.01 ±0.09	11.89±0.08	0.003±0.01	0.08±0.02	3.39±0.02

Table 3: Toxic Heavy Metals Present in Different Tea Samples (mg/kg)

Tea Samples		Concentration (mg/kg)				
		Pb	**N_1**	**Cr**	**Cd**	**Co**
1	Typhoid tea	0.27±0.02	0.09±0.01	ND	ND	0.93±0.05
2	Green tea	ND	ND	ND	ND	0.04±0.01
3	Top tea	ND	ND	0.39±0.03	ND	ND
4	Lipton tea	ND	ND	1.27±0.08	ND	0.11±0.01
5	Lung flush tea	ND	ND	0.72±0.01	ND	0.06±0.01
6	Anti malaria tea	ND	ND	1.04±0.03	ND	0.01±0.01
7	Tummy fat reducing tea	ND	ND	0.43±0.03	ND	0.02±0.02
8	Ballerina tea	ND	ND	0.63±0.08	ND	ND
9	Super herb sliming tea	ND	ND	ND	ND	ND
10	Diabetes tea	ND	ND	ND	ND	0.01±0.01

RESULTS AND DISCUSSION

Heavy metals pollution is a major environmental problem. They accumulate in the environment and eventually find their way into the bodies of living organisms.

The heavy metal and trace metal concentrations in commercially available tea brands were determined by flame atomic absorption spectrometry. The results are given in Table 2 and Table 3. Zinc, iron, manganese, copper and magnesium were present in all the tea samples. Iron has the highest value of 18.11mg/kg in typhoid tea and 11.89mg/kg in Diabetes tea followed by zinc with a value of 10.45mgkg in Antimalaria tea. Top tea and Slimming tea contained high values of copper (0.11mg/kg and 0.11mg/kg respectively).

A high level of chromium was detected in Lipton tea, Anti malaria tea and Lung flush tea. Nickel was detected only in Typhoid tea while cadmium was not detected in the tea samples at all. High levels of cobalt were also detected in Typhoid tea and Lipton tea.

Typhoid tea is highly polluted with lead, nickel and cobalt followed by Lipton tea (which is polluted with chromium and cobalt) and Anti malaria tea. Precaution should be taken when taking these teas. All the tea samples collected were enriched with iron and zinc. Iron is a useful element and a significant part of blood in human bodies (Lesniewicz *et al.*, 2006). The mineral metal content of the samples was found to be higher than these of toxic heavy metals.

Although, tea is a rich source of dietary metal intake, it could be a source of toxins in individuals that consumes it. Heavy metals accumulate in tea plants due to soil pollution. Tea can also be considered an important source of iron, zinc, manganese and magnesium (Aloud, 2003). Although, Aloud (2003) reported low values of toxic metals in tea leaves, Seenivasan *et al.*, (2008) reported high levels of heavy metals in tea leaves and also showed toxic effects of zinc, iron, copper and manganese. The levels of manganese are within the permissible level for drinking water by WHO (1996, 1998) but the levels of lead, nickel, chromium and cobalt were above the permissible level for drinking water.

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